Is being left-handed a handicap? The short and useless answer is "yes and no."

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Certainly in earlier days, sinistrality was a problem for children learning to write. An eminent sinister-handed Dallas plastic surgeon reported: "In parochial summer school the nuns were determined to change me and actually tied my left hand behind my back. The result of this action was tremendous tenacity and endurance! . . . We write left to right and smear our fresh ink across the page." He added: "Numerous theories throughout history have claimed that being left-handed causes developmental and immune disorders. It has also been said that left-handers die younger, have more diseases and are even considered inept. None of these theories have been proven" (1).

Remember that Ben Franklin had a miserable left-handed childhood and as an adult wrote "A petition to those who have the Superintendency of Education" in which he recorded, "If by chance I touched a pencil, a pen, or a needle I was bitterly rebuked; and more than once I have been beaten for being awkward and wanting a graceful manner." He ended his epistle by signing it, "I am with profound respect, Sirs, your obedient servant. THE LEFT HAND" (2).

It is generally thought that there is an increased incidence of injuries in left-handed people because we live in a right-handed world and have done so for many centuries. Some would have us believe we are right-handed because our early hominid ancestors are thought to have coupled early speech to muscle actions already lateralized to our brain's left hemisphere at an earlier point in hominid evolution; I tend to prefer the concept of Calvin (3), who suggested that "selective pressures on infant carrying females throwing missiles when hunting led to preferential right-handedness; they carried their infant on the left side of their body where the heartbeat is stronger and thereby keeping the infant more secure and quiet."

Today the environment of our world strongly favors the right-handed majority. Adusumilli et al (4) in their paper published in 2004 catalogued some of the hazards facing the sinister handed. "Although they are considered to be more intellectual, and artistic, studies have documented that they are more prone to unintentional injuries, head trauma, motor vehicle accidents, and increased sports injuries. Left-handed industrial workers are 5 times more prone to finger amputations than right-handed workers." Coren (5) in 1989 enumerated many of the problems left-handers are faced with: "Everyday implements such as gearshifts, scissors, and can openers are biased toward right-handed use." Even in their homes the sinistrals are forced to accommodate to everyday items such as spiral-bound notebooks with the spiral on the "wrong" side, electric irons with the power cable protruding on the right, corkscrews, light bulbs, garden secateurs, and potato peelers.

On entering a building, we right-handers instinctively turn to our right; intelligent shopkeepers know this and display attractive, and usually expensive, goods on the right. Even traffic patterns are designed to utilize this right-turning bias.

Nine different professional groups were studied by Schachter and Ransil (6) in 1996 on handedness distributions in approximately equal numbers of accountants, architects, dentists, lawyers, librarians, mathematicians, orthodontists, orthopaedic surgeons, and psychiatrists. Three hundred people from each profession were asked, by mail, their age, sex, and whether they considered themselves right- or left-handed or ambidextrous. Of the 2007 questionnaires mailed, 1196 (44%) were returned.

The data regarding their verbal skills, visuospatial skills, bimanual fine motor skills, and mathematical skills were submitted to various computations in which the available responses were always left, usually left, no preference, usually right, and always right. From the average laterality scores, it appears that orthopaedic surgeons, librarians, and mathematicians are mostly right-handed and that lawyers and architects are either the least right-handed or the most left-handed. The differences between mathematicians/librarians and orthodontists/dentists were neither statistically nor clinically significant. Any influence of sex was considered inconclusive because of the 9-to-1 disproportion of male to female responders.

So how do left-handed surgeons and orthodontists get along at work? In general, just like their right-handed colleagues, but there seems to be a longer learning curve.

In their paper "Left-handed surgeons: are they left out?" Adusumilli et al (4) surveyed 68 surgeons in the New York City

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area, of whom only 5 were female; 31% were ambidextrous and 69% were left-handed. Among the left-handed, they found considerable difficulty using long vascular needle holders, heavy hemostatic clamps, and right-handed scissors. Twenty-eight percent felt prone to needle sticks and other hazards. Operations such as cholecystectomy, right hemicolectomy, pelvic operations, and procedures around the gastroesophageal junction were difficult to learn when standing on the right side of the operating table.

ORTHOPAEDICS

Recently a few scientific papers have appeared on potential laterality problems associated with the work of right-handed surgeons. In June 1994, Moloney et al (7) examined the preoperative and postoperative x-rays of fixation of 244 basic cervical or intertrochanteric hip fractures. Sliding hip screws were used. Their conclusion was that malpositioning of the 12 failures occurred significantly more frequently on the left than on the right in a unit where all the orthopaedic surgeons were right-handed.

In 2007, Mehta and Lotke (8) published a paper titled "Should right-handed surgeons do only right total knee arthroplasties?" They reported on a series of 728 primary total knee arthroplasties (TKA) with the surgeon standing on the side of the operative limb. Laterality is said by some to play a larger role in orthopaedics than in general surgery, and these authors found no references to handedness as a factor affecting surgical techniques and results.

They posed the hypothesis that a right-handed surgeon with a subjective impression of increased comfort operating on the right side of a patient receiving a right TKA would have better outcomes doing right TKAs than left TKAs. Right-handed Dr. Lotke did all the operations standing on the side of the operative leg. One year later, Extension and Knee Society function and pain scores were statistically better for right knees than for left knees. They have not yet established the reasons for this difference but suggest they may be due to dexterity or proprioception.

LAPAROSCOPY

The current belief that laparoscopy with minimally invasive instruments has eliminated difficulties for left-handed surgeons is not supported by Adusumilli et al. This technique involves a more static posture of the neck and trunk with more frequent awkward movements of the upper limbs than with open operations. Twenty-five percent said that their patients never noticed their laterality, and 60% said patients noticed several times. Surprisingly in this survey, 10% expressed concern at the idea of being operated on by a left-handed surgeon!

Mehta and Lotke (8) quoted in their paper "objective and quantitative evidence showing a difference in laparoscopic psychomotor performance between right- and left-handed residents" (9, 10). Data also supported left-handed general surgeons having longer operative times than right-handed surgeons with "right-handed" laparoscopic equipment, portal locations, and the anatomical location of the gallbladder (11).

From the University Hospital in the Canary Islands, a well-illustrated paper by Herrero-Segura et al (11) reported how a left-handed surgeon did 52 safe laparoscopic cholecystectomies using standard right-handed instruments.

DENTISTRY

The discipline of dentistry demands a high degree of manual dexterity as well as mental imagery. It might be thought that sinistrality would be a handicap, but this is not so, at least in Great Britain. Henderson et al (12) studied the prevalence of sinistrality in 70 dental students and 170 orthodontists. The students reported an 8.6% incidence of left-handedness and the orthodontists a 17.2% incidence. Both groups showed many more mixed handers than in the general population. Subjective comments by the two groups reported that sinistrality was a general inconvenience. "Self taught to be ambidextrous" was often remarked. Right-handed dental units were a minor inconvenience.

"There is no evidence that being left-handed is in any way a hindrance to becoming a consultant specialist and any reference to a person's laterality with regards to their professional ability could be viewed as a form of discrimination," they stated.

Some interesting comments were found in the introduction: "An increased incidence of sinistrality is noted among those who use their hands with a high degree of skill" and "the incidence of sinistrality among veterinarians with a small-animal practice was twice the normal value"!

ATHLETICS

In competitive sports, left-handed participants can be of value when facing right-handed opponents. Raymond et al (13) postulated that "left-handers have a frequency-dependent advantage in fights and for that reason a fitness advantage." There is a higher proportion of left-handed individuals in interactive sports than in the general population. The proportion reaches 50% in sports such as fencing, 32% in table tennis, 23% in badminton, 18.5% in cricket(!), and 15% in tennis. In baseball, left-handedness is advantageous to pitchers, batters, first basemen, and outfielders.

In 1988, E. K. Wood published a letter in *Nature* (14): "It has been suggested that handedness influences life expectancy—the influence being that left-handers really are more gauche and maladroit than their more dexterous counterpoints." Using the statistics on birth, death, and handedness in the Baseball Encyclopedia, he concluded there is no statistical difference between mortalities of left-handed and right-handed baseball players. The statistics support the claim that the percentage of left-handers in the population declines dramatically above age 50.

In combat sports such as boxing, rugby in its national variations, and American football, no such figures are available. Left-handed fencers are said to have an advantage when using a sword or a foil but apparently not when wielding a sabre!

TRAUMA AND THE LEFT-HANDED

Most industrial tools are made for the right-handed, thus forcing the sinister handed to work with his less proficient right hand or adopt work and postural patterns that the machines or tools do not readily accommodate. In Dallas there is a gigantic and deservedly famous hardware store whose owner recently

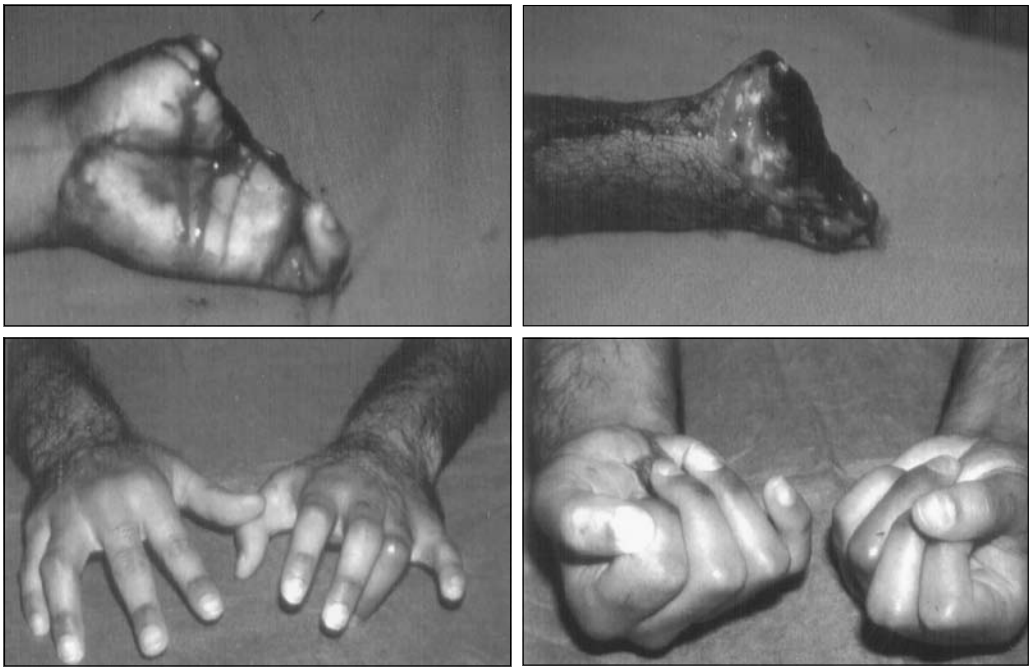

Figure. Bilateral traumatic amputations through the palm and the result after surgical reattachment. Courtesy of David Zehr, MD.

told me that the only left-handed tool that he stocks is a tin snip for sheet metal workers.

Many power tools, in their usual configurations, provide for free use of the right hand to manipulate materials, while restricting movements and utility of the left hand, as can be seen in lathes, band saws, and some milling machines. Thus, to function in the right-handed world, the left-hander must either work with his nondominant and less proficient right hand or must adopt body postures and manipulation patterns that are at variance with the design of the machines. Such activities place the sinistral at a higher risk of suffering an accidental injury.

The Centers for Disease Control and Prevention (15) reported that 20,000 accidental digital amputations occur in the USA each year, but these are a mere fraction of the severe injuries that happen. In a paper published in 1995, Taras, Behrman, and Degnan (16) retrospectively reviewed the charts of 125 patients who had been treated for a digital amputation (defined as proximal to the nail plate). A second group of 116 patients treated for minor hand trauma was also evaluated. The incidence of left-hand dominance was 35% in the amputation group and 11% in the minor trauma group. A left-handed individual was more likely to sustain an amputation both at home and at work. The left-handed were more likely to have a dominant hand amputation than were the right-handed (70% compared with 51%). These data suggest that left-handers have an amputation risk factor 4.9 times greater than that of right-handed people. The minor hand trauma occurred at rates similar to left-handedness in an average population.

Twenty years ago, the journal *Fine Woodworking* published a survey of 1000 injured woodworkers written by an amateur woodworker but full-time hand surgeon, E. J. Justis (17). Eight hundred sixty-four of the 1000 were right-handed, but 600 of their injuries were to the left hand, and 530 of the left-handed injured their right hand. Failure to use properly installed guards was the most common cause of injury. Fatigue did not appear to be an important factor since 845 injuries occurred within the first 5 hours of work. Additionally, 340 of the injuries occurred between noon and 3:00 PM and may have been caused by what the authors tactfully describe as "postprandial somnolence or circadian rhythm factors." In the summary of the paper, he and his colleagues reported that "woodworking equipment produces approximately 720,000 injuries per year which often cause severe psychological and functional impairment."

CONCLUSION

For those who have all ten digits and are left-handed, be happy; you are in good company. So many famous people did well despite their sinister "handicap"; even 25% of the Apollo astronauts were left-handed.

If you have lost bits of your digits, whole digits, or even a hand, you can still do well in the 20th century. If the amputated portions are not available, take heart; you could still be a surgeon. A classic paper by hand surgeon Paul W. Brown, titled "Less than ten—surgeons with amputated fingers" (18), surveyed 183 surgeons who had lost parts of their hands. Twenty-nine surgeons had lost significant parts of a thumb, and 28 had multiple digit loss. Half sustained their loss after becoming surgeons. Most of the losses were caused by mechanical trauma; one had his finger bitten off by an orangutan and another while shark fishing. One of two with congenital defects was a pediatric orthopaedist with significant loss of eight digits. Of those who lost fingers after completing their surgical training, only three quit operating. Several surgeons claimed that their digital loss stimulated them to become ambidextrous, thus improving their surgical skills.

Dr. Brown concluded his paper with this statement: "There are very few activities for which 10 digits are needed. The ability to adjust to an amputation injury by being successful in one's pursuits depends on patient motivation as well as the specific injury."

It is now over a quarter of a century since Dr. Brown published his paper, and hand surgery has since developed techniques whereby freshly amputated fingers, thumbs, and even whole hands can be successfully reattached, as shown in the *Figure*. Dr. David Zehr kindly allowed me to show this example of his excellent work.

Finally, for you sinistrals, don't forget to celebrate on August 11. It's "International Left-Handers Day."

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